IBERGRID 2008

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

"Spanish Supercomputing Network"

Porto, 13 May 2008

Francesc Subirada
Associate Director

Introduction: National Center & Spanish Network

- The BSC-CNS is the Spanish National Supercomputing Center, created with the objectives of doing R&D (in Computer Sciences, Life Sciences and Earth Sciences) and supporting Supercomputing needs of Spanish Researchers.

- The Spanish Supercomputing Network (RES) is a project lead by Spanish Government that consists in the creation of a supercomputing distributed infrastructure to enhance, transparently the end user, the supercomputing support to Spanish research groups.

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Introduction: National Center & Spanish Network

- RES members are, in addition to BSC-CNS, are:
  - Centro de Supercomputación y Visualización de Madrid (CeSViMa)
  - Instituto de Astrofísica de Canarias
  - Universidad de Cantabria
  - Universidad de Málaga
  - Universidad de Valencia
  - Universidad de Zaragoza

MareNostrum

- MareNostrum 2006
  - 10240 PowerPC 970 cores
    - 2560 JS21 2.3 GHz
    - 20 TB of Memory
    - 8 GB per node
  - 380 TB Storage Capacity
  - 3 networks
    - Myrinet
    - Gigabit
    - 10/100 Ethernet
  - Operating System
    - Linux 2.6 (SuSE)

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Red Española de Supercomputación

MareNostrum

Processor: 10240 PowerPC 970 2.3 GHz
Memory: 20 TBytes
Disk: 280 + 90 TBytes
Network: Myrinet, Gigabit, 10/100
System: Linux

UPM

Processor: 2408 PowerPC 970 2.2 GHz
Memory: 4.7 TBytes
Disk: 63 + 47 TBytes
Network: Myrinet, Gigabit, 10/100
System: Linux

IAC, UMA, UC, UZ, UV

Process: 512 PowerPC 970 2.2 GHz
Memory: 1 TByte
Disk: 14 + 10 TBytes
Network: Myrinet, Gigabit, 10/100
System: Linux

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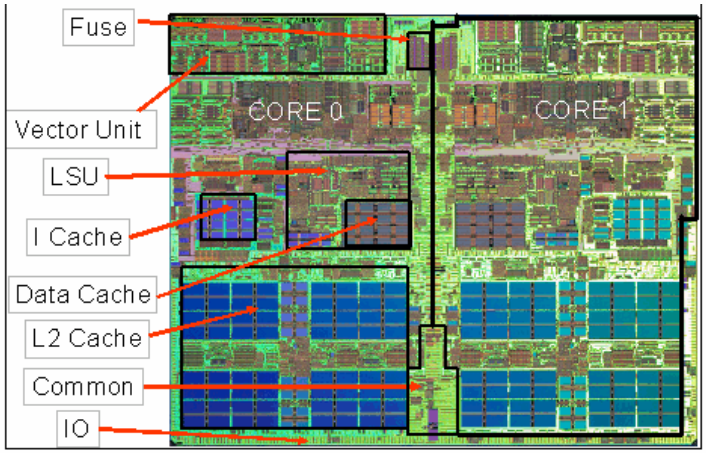
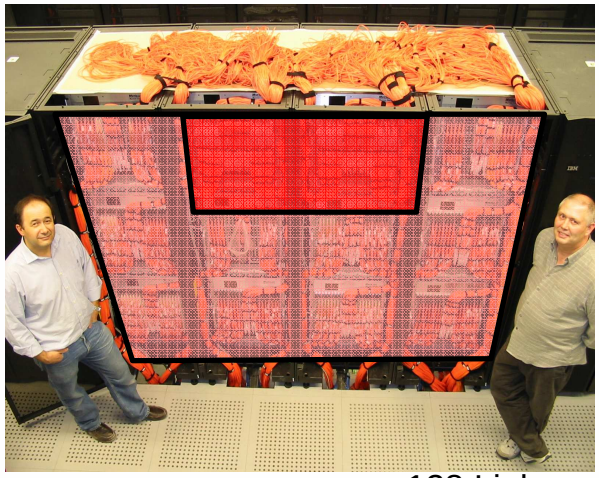
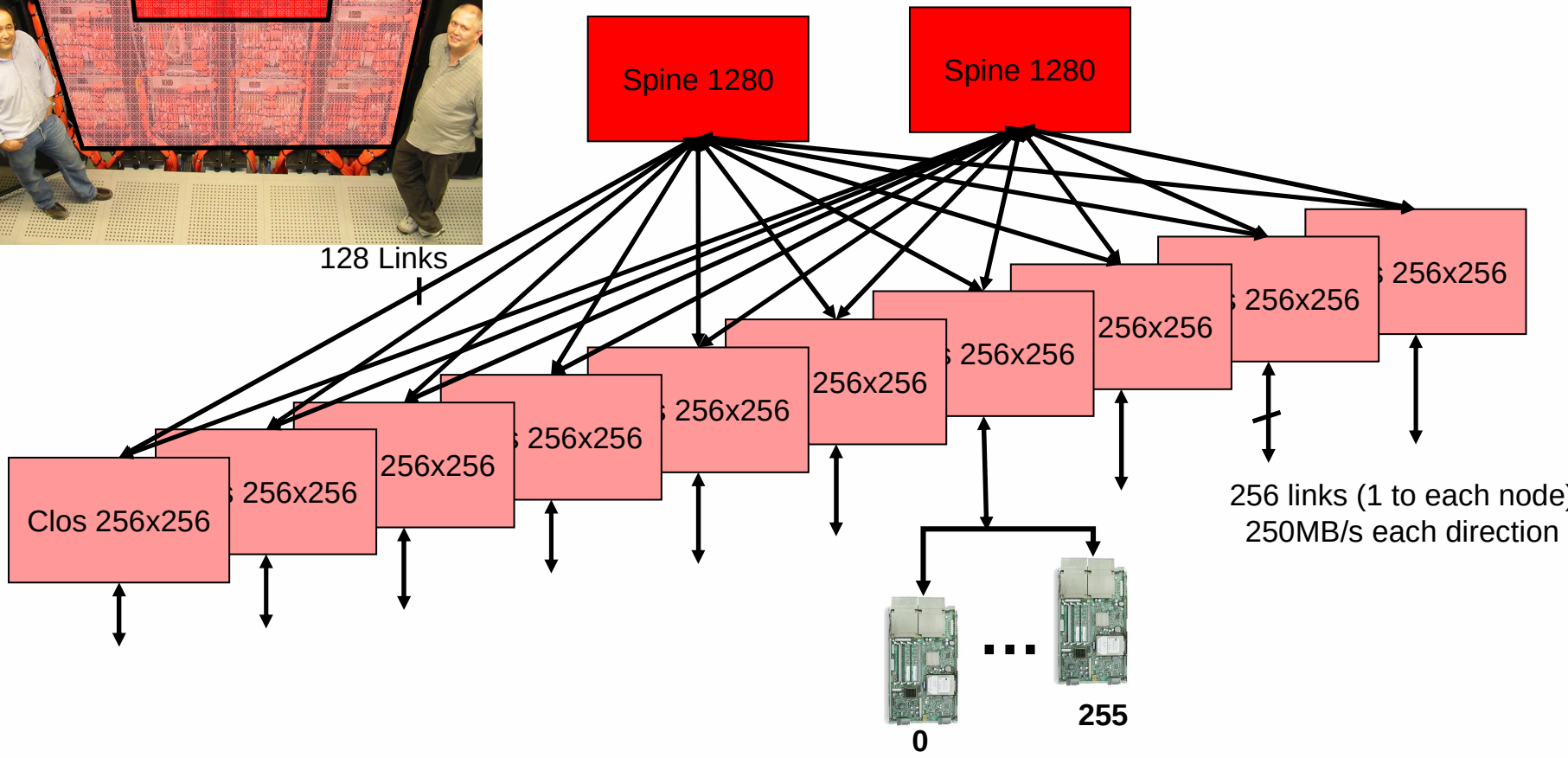
Processors, Blades, BladeCenters and Racks



Interconnection network: Myrinet





RES Supercomputers

Magerit

Altamira

CaesarAugusta

LaPalma

Picasso

Tirant

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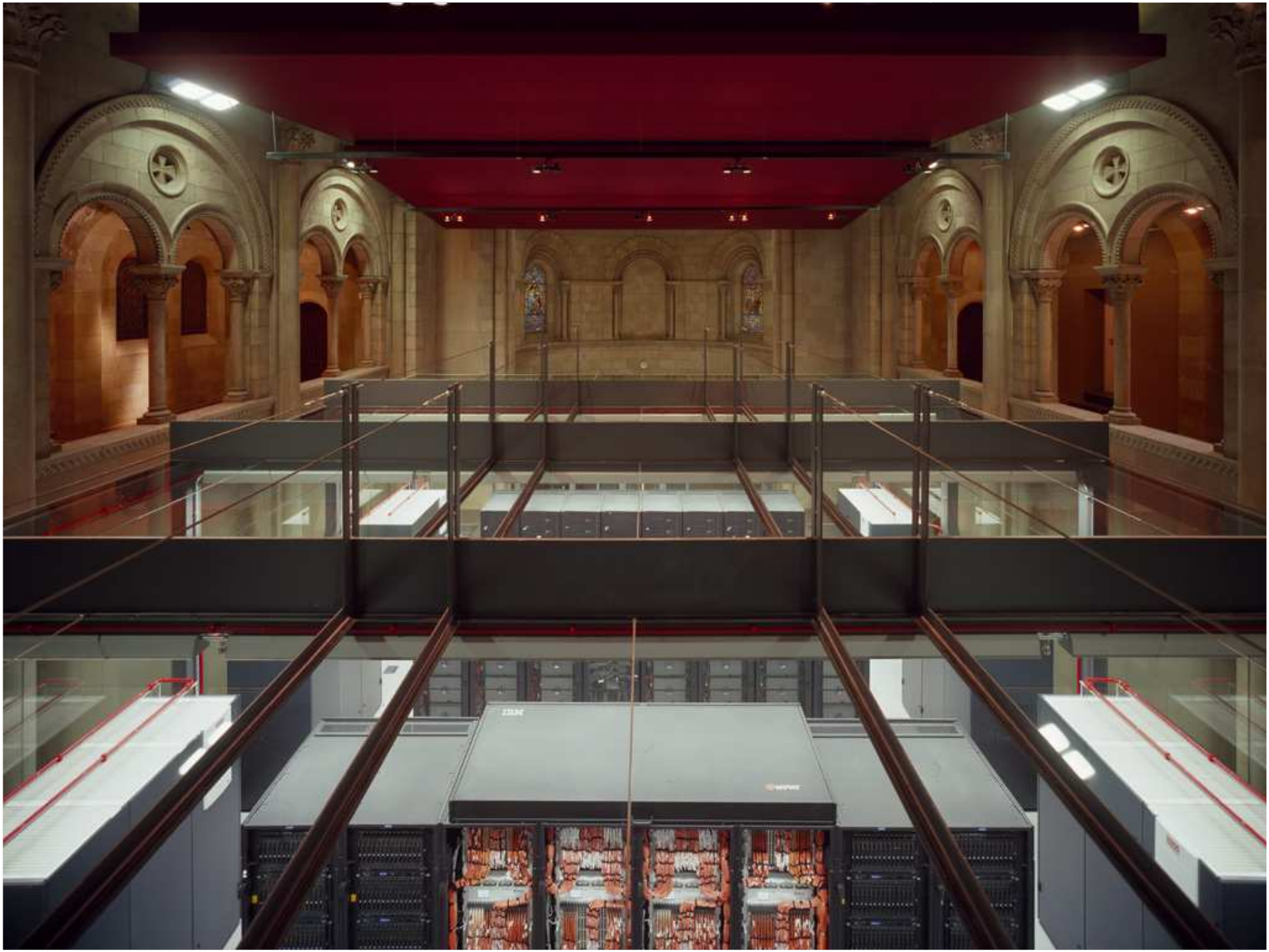
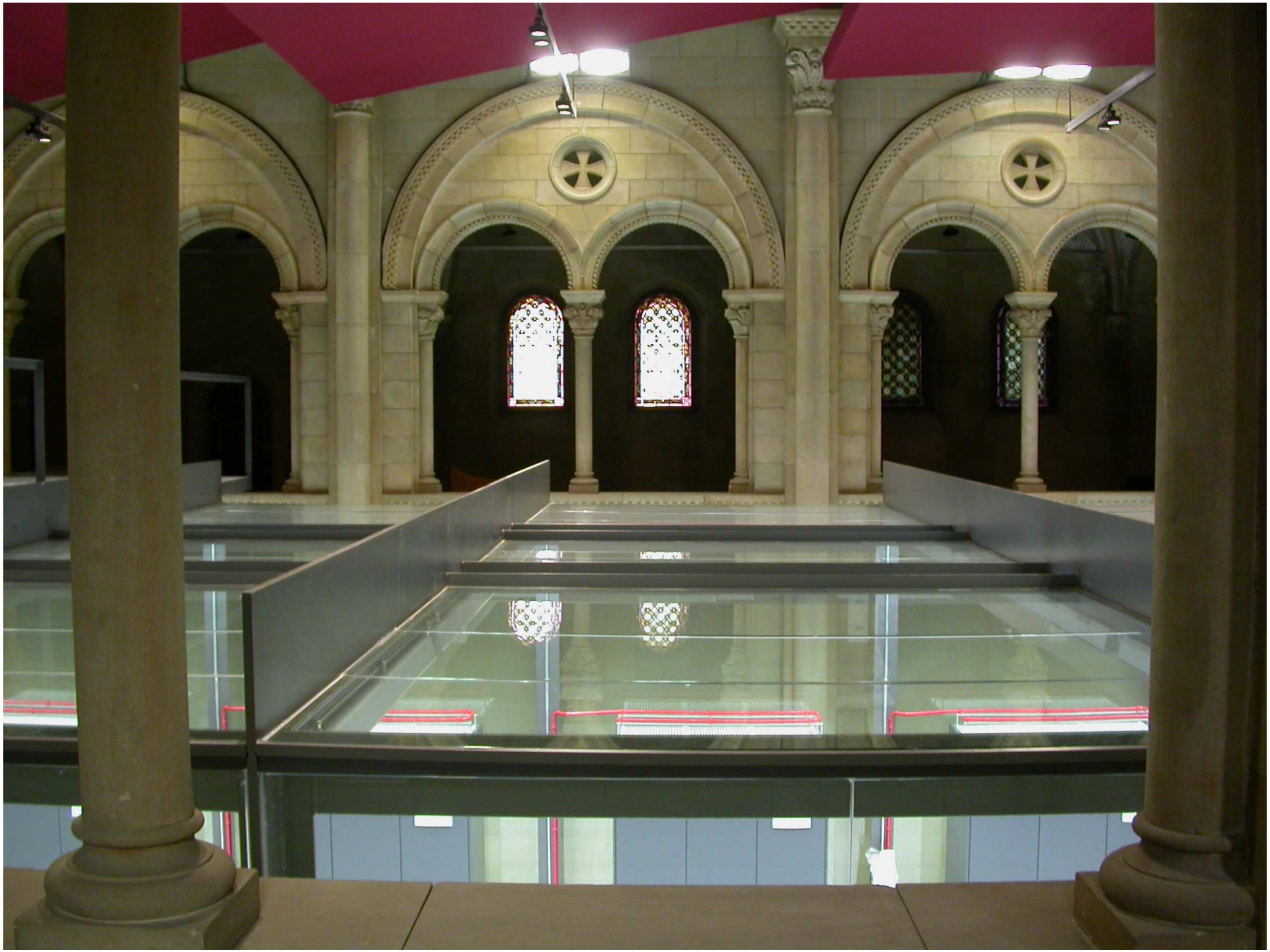
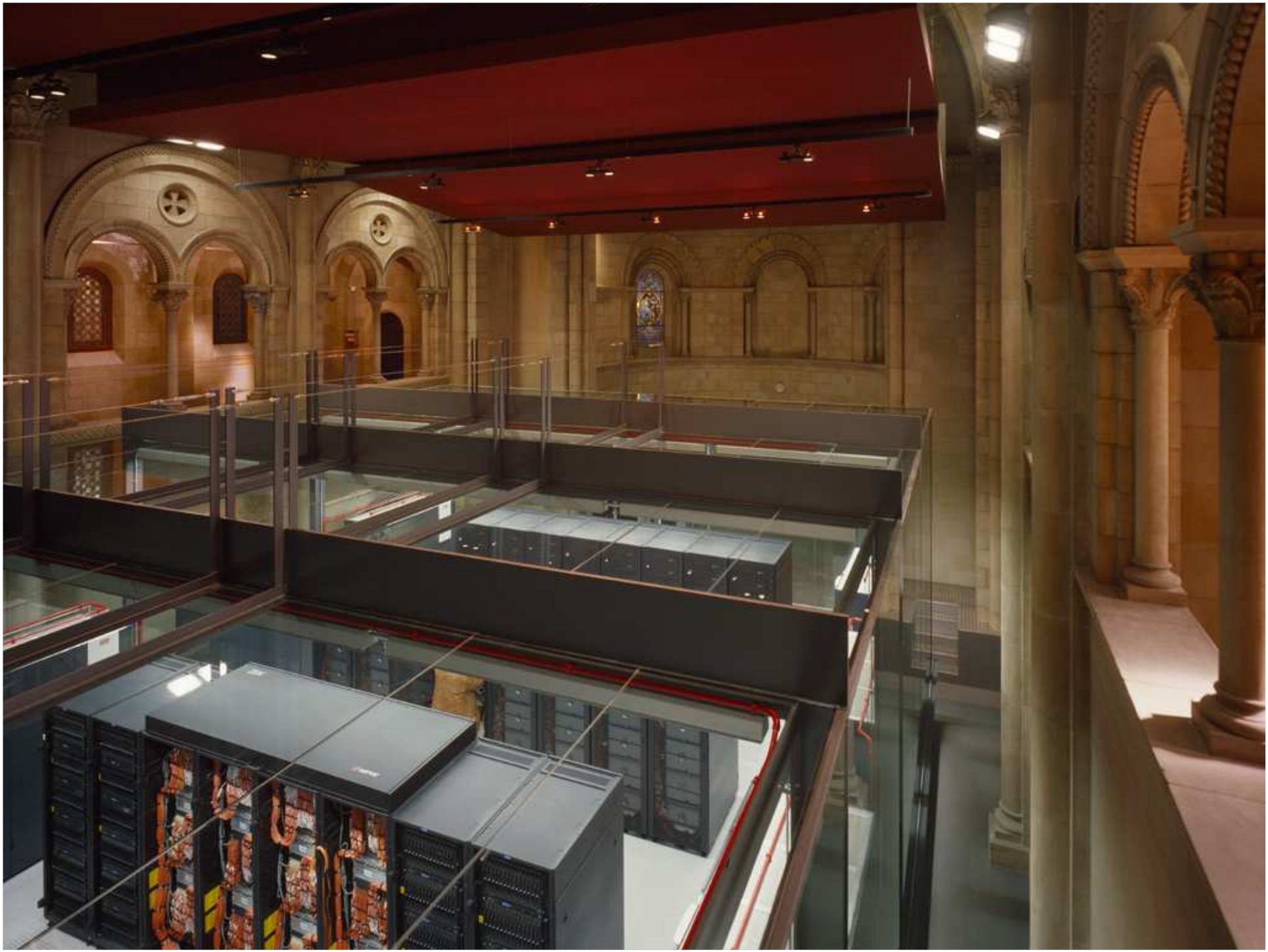
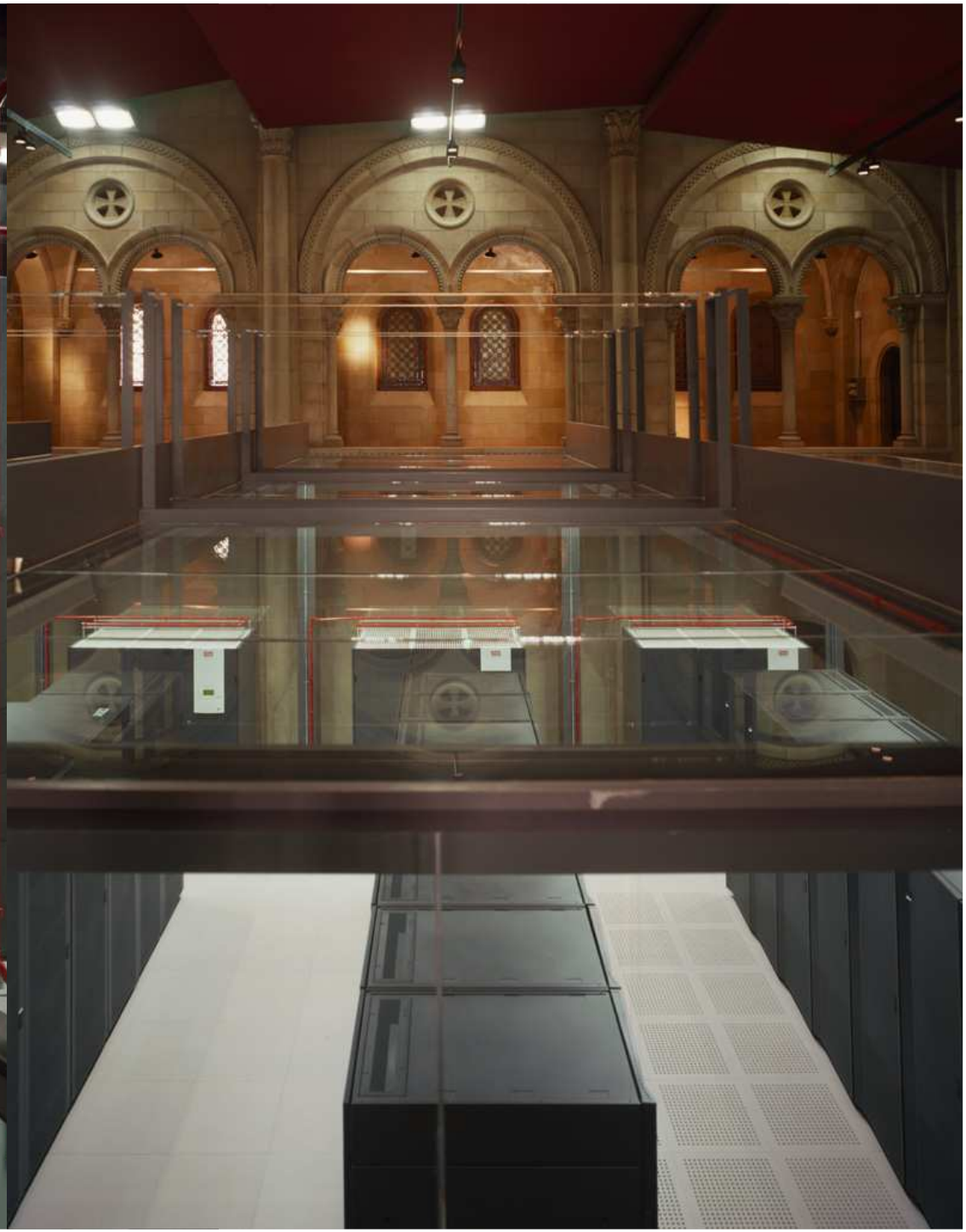


Location







IBM

MareNostrum

- MareNostrum evolution:

List	WW	Europe
Noviembre 2004	4	1
Junio 2005	5	1
Noviembre 2005	8	1
Junio 2006	11	3
Noviembre 2006	5	1
Junio 2007	9	1
Noviembre 2007	13	3

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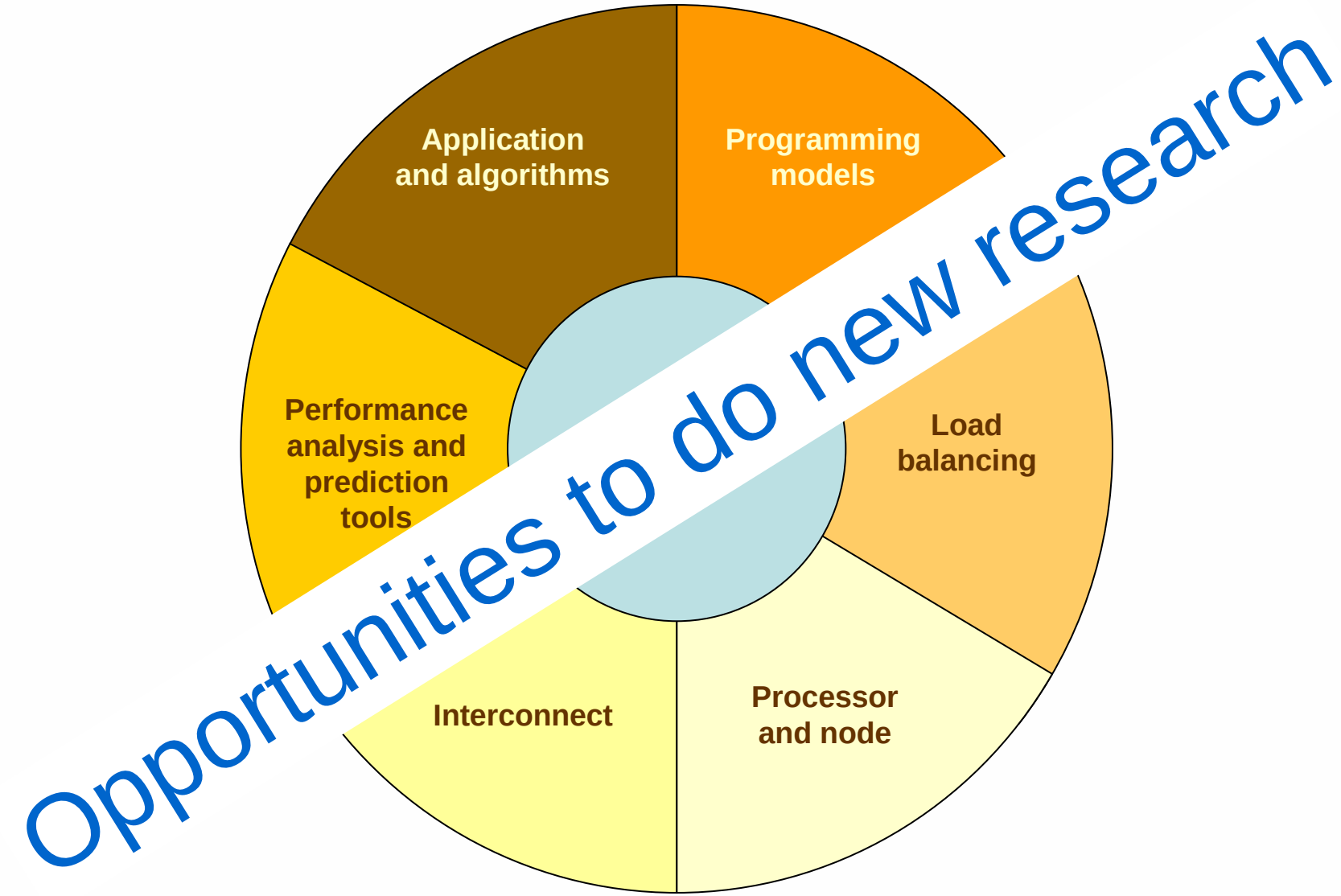
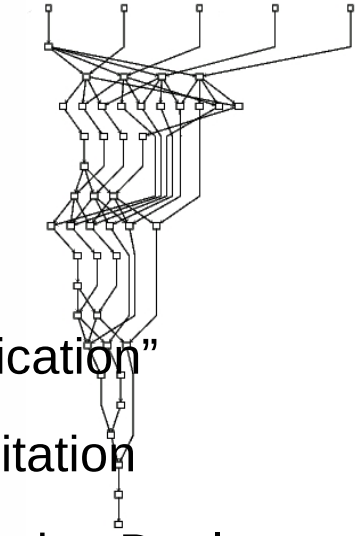
IT Research at BSC-CNS

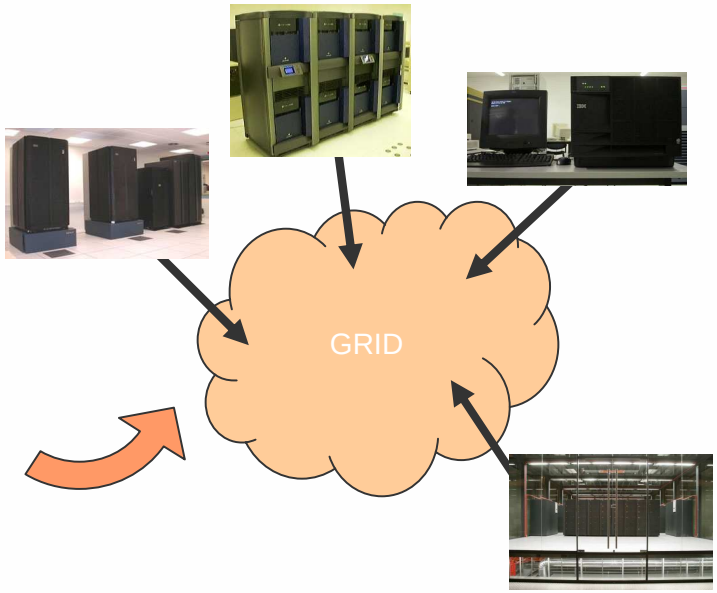


GRID Superescalar

```
main (){
...

   for (i = 0; i < DIM; i++) {
     for (j= 0; j< i-1; j++){
        for (k = 0; k < j-1; k++) {
            sgemm_tile( A[i][k], A[j][k], A[i][j] );
        ...
```

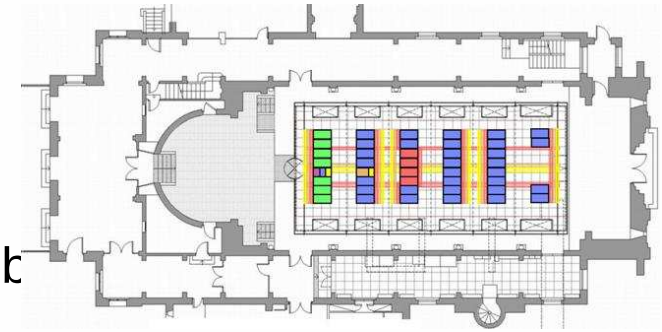




GRID superscalar offers:

- Automatic “Gridification”
- Parallelism exploitation
- Automatic Application Deployment
- Execution Monitoring
- Open Source Distributions at the BSC web

Custom Version for MareNostrum



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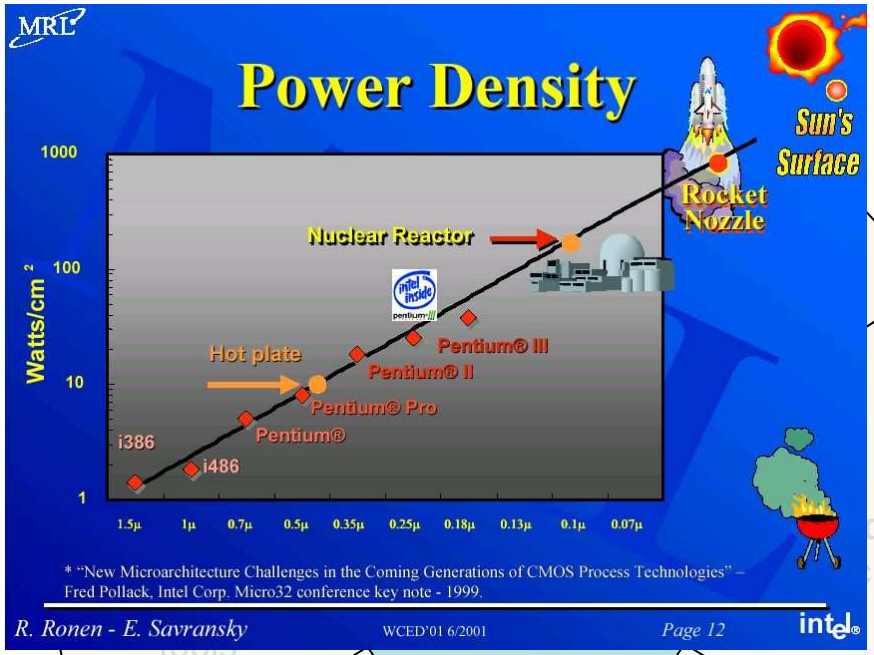
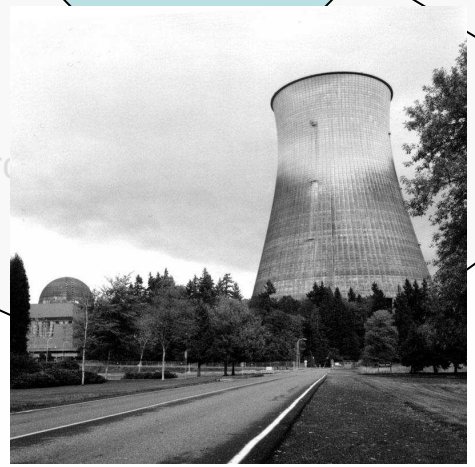
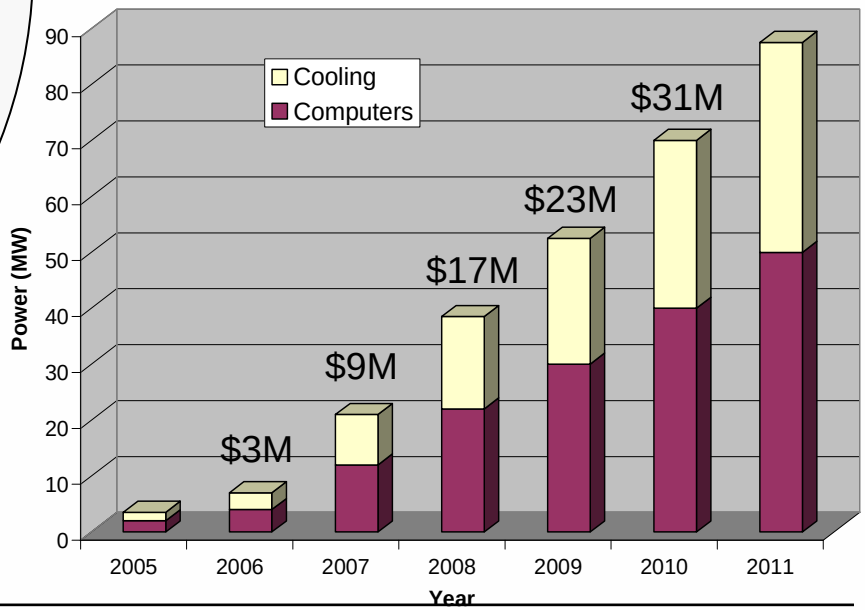
The power issue



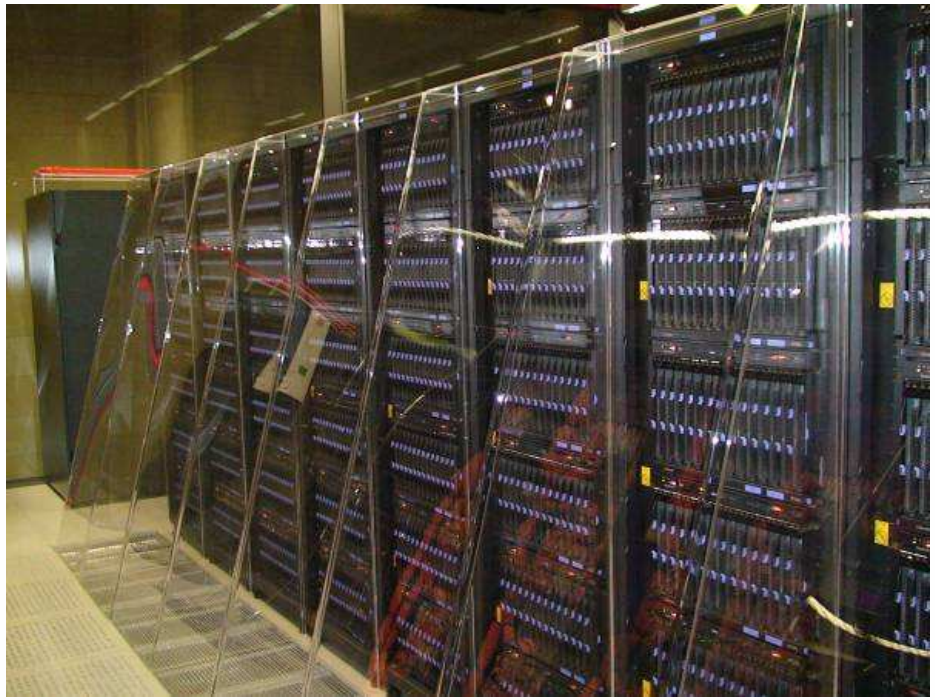


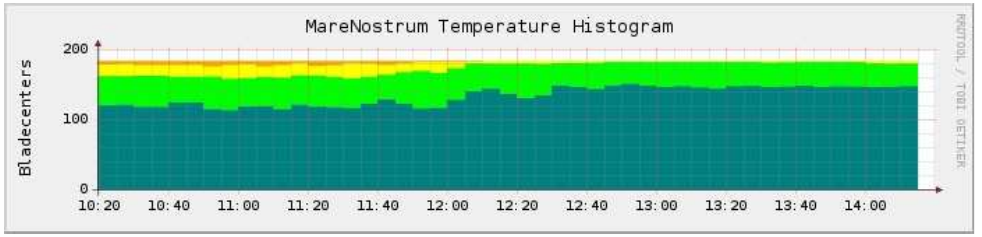
Google

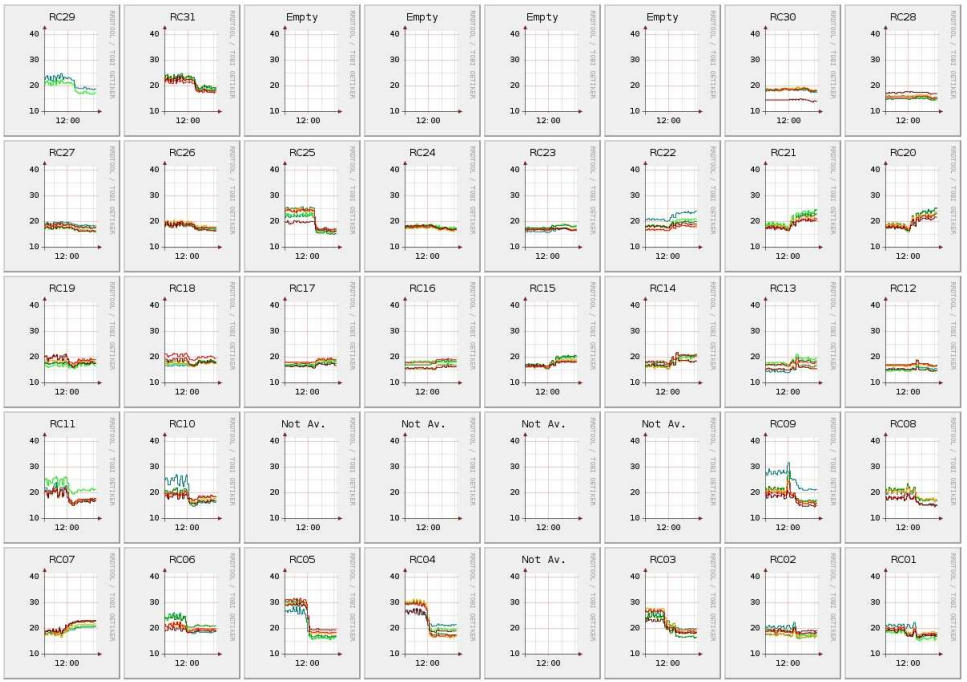
Computer Center Power Projections



Power and money

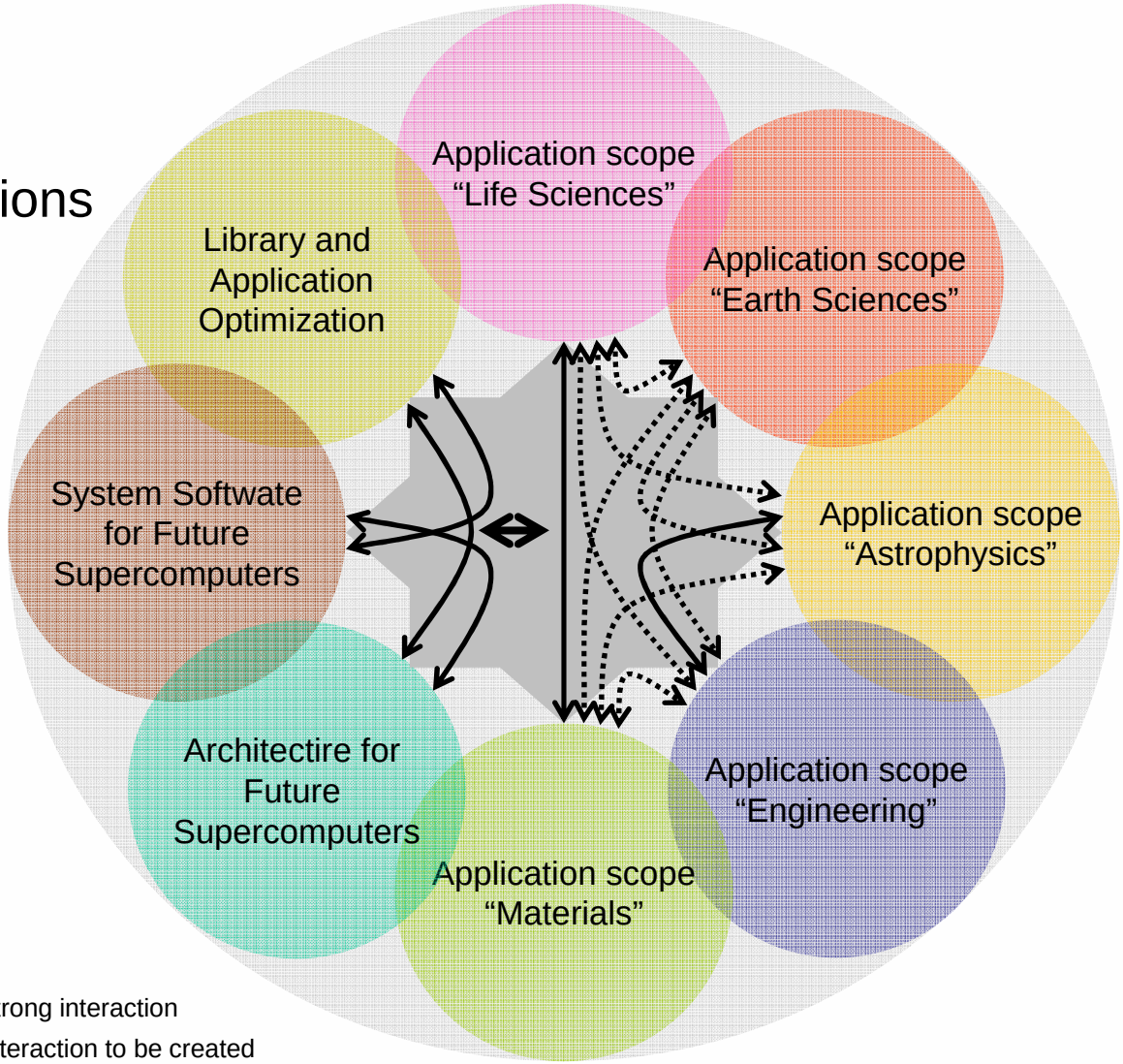




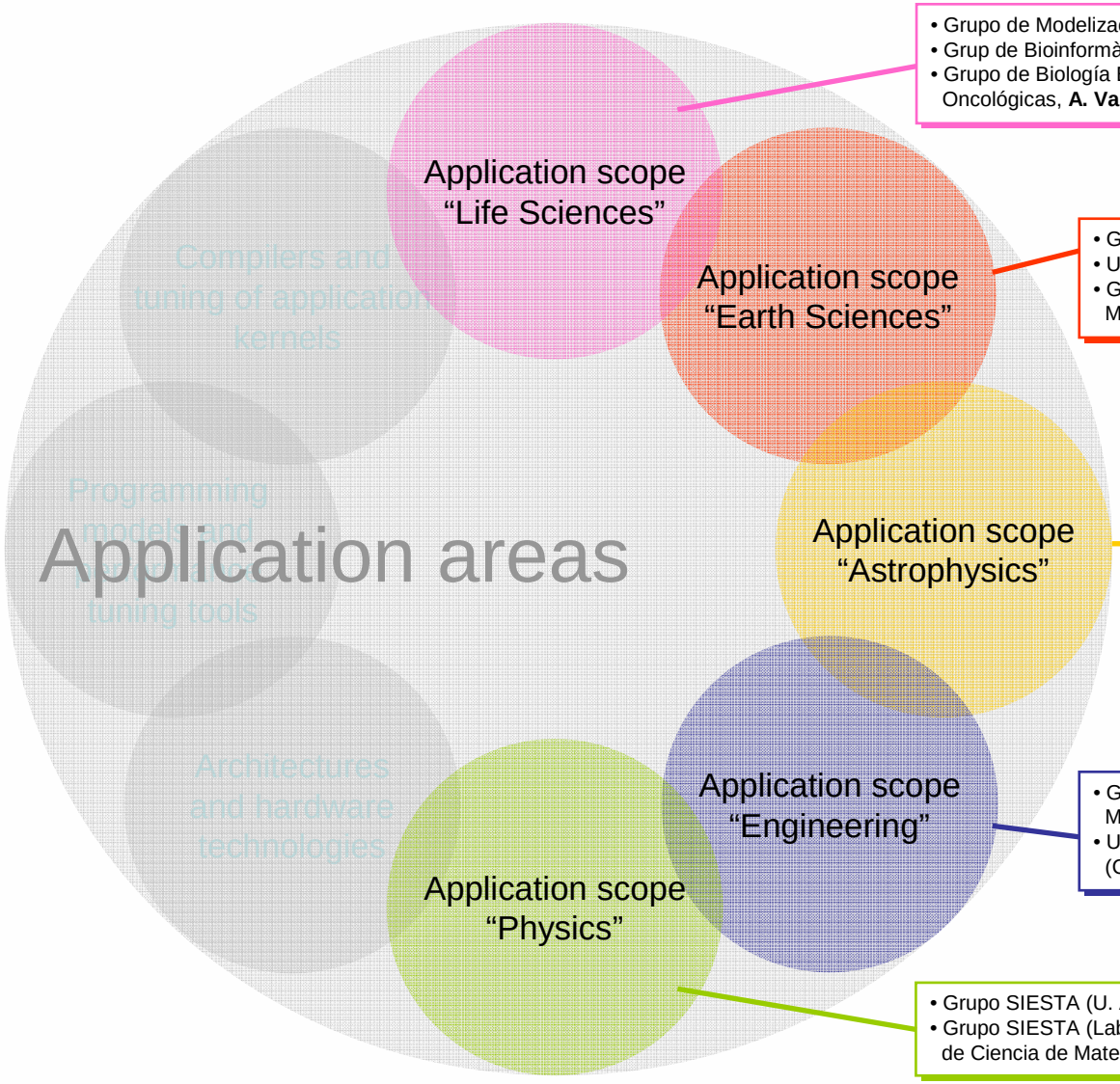


Supercomputing and e-Science Consolider program

- 22 Spanish groups
- 119 senior researchers
- 5 Grand Challenge applications



Supercomputing and e-Science: research areas and groups (1)



- Grupo de Modelización Molecular y Bioinformática (U. de Barcelona, **M. Orozco**)
- Grup de Bioinformàtica del Genoma (Centre de Regulació Genòmica, **R. Guigó**)
- Grupo de Biología Estructural Computacional (Centro Nacional de Investigaciones Oncológicas, **A. Valencia**)

- Grupo de Ciencias de la Tierra (BSC-CNS, **J. M. Baldasano**)
- Unidad de Contaminación Atmosférica (CIEMAT, **F. Martín**)
- Grupo de Diagnóstico y Modelización del Clima (U. Complutense de Madrid, **R. García-Herrera**)

- Grupo de Astrofísica Relativista y Cosmología (U. de Valencia, **J. M. Ibáñez**)
- Grupo de Simulación Numérica de Procesos Astrofísicos (Instituto de Astrofísica de Canarias, **F. Moreno**)
- Grupo GAIA de Astronomía Galáctica (U. de Barcelona, **J. Torra**)
- Grupo de Cosmología Computacional (U. Autónoma de Madrid, **G. Yepes**)

- Grupo de Mecánica de Fluidos Computacional (U. Politécnica de Madrid, **J. Jiménez Sendín**)
- Unidad de Simulación Numérica y Modelización de Procesos (CIEMAT, **M. Uhlmann**)

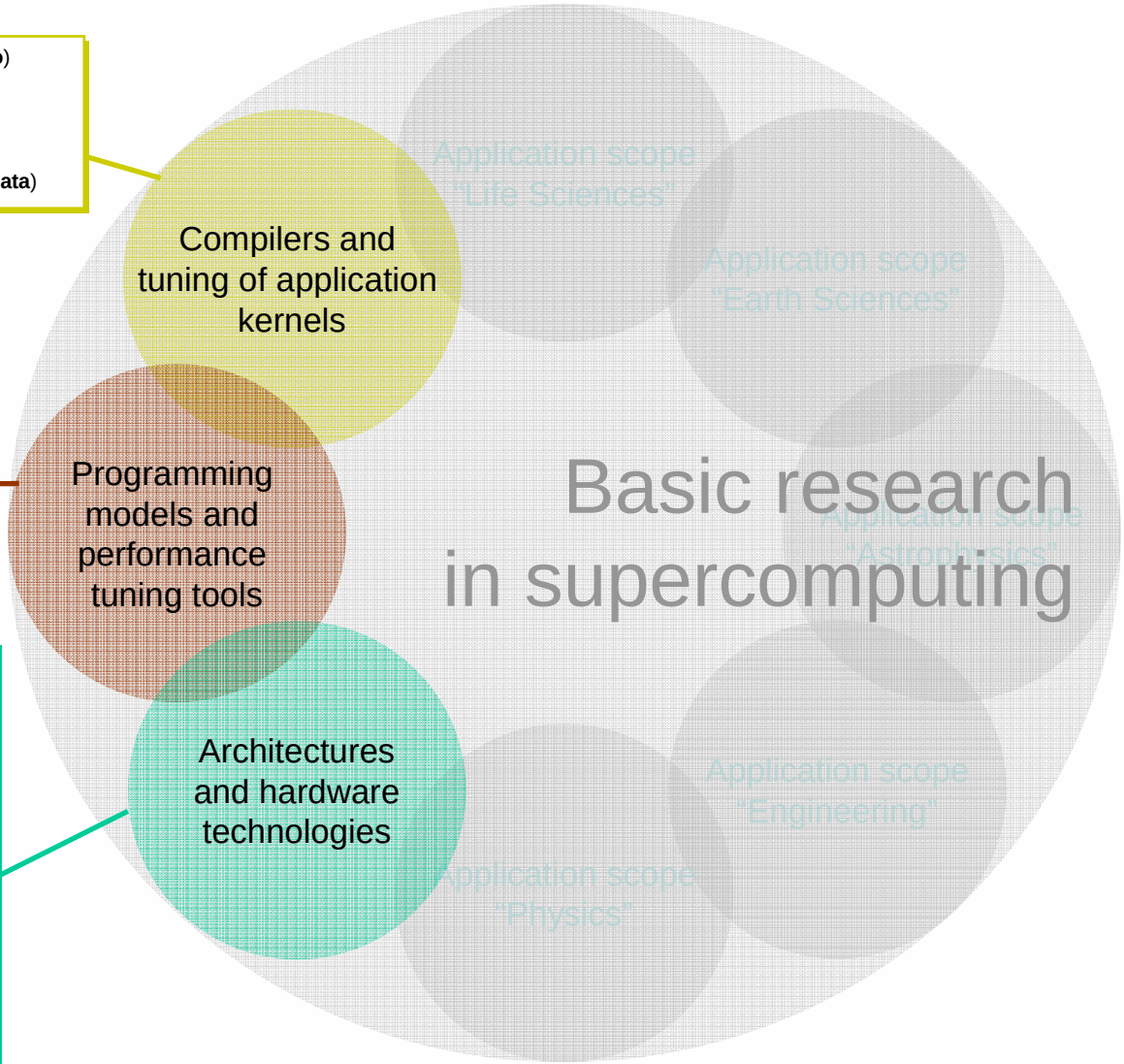
- Grupo SIESTA (U. Autónoma de Madrid, **J. M. Soler**)
- Grupo SIESTA (Laboratorio de Estructura Electrónica de los Materiales del Instituto de Ciencia de Materiales de Barcelona ICMAB-CSIC, **P. J. Ordejón**)

Supercomputing and e-Science: research areas and groups (2)

- Departamento de Tecnologías de la Información (BSC-CNS, **M. Valero**)
- Grupo Computación de Altas Prestaciones (U. Politècnica de Catalunya, **J. M. Llabería**)
- Grupo de Arquitectura y Tecnología de Sistemas Informáticos (U. Complutense de Madrid, **F. Tirado**)
- Grupo de Arquitectura de Computadores (U. de Malaga, **E. López Zapata**)

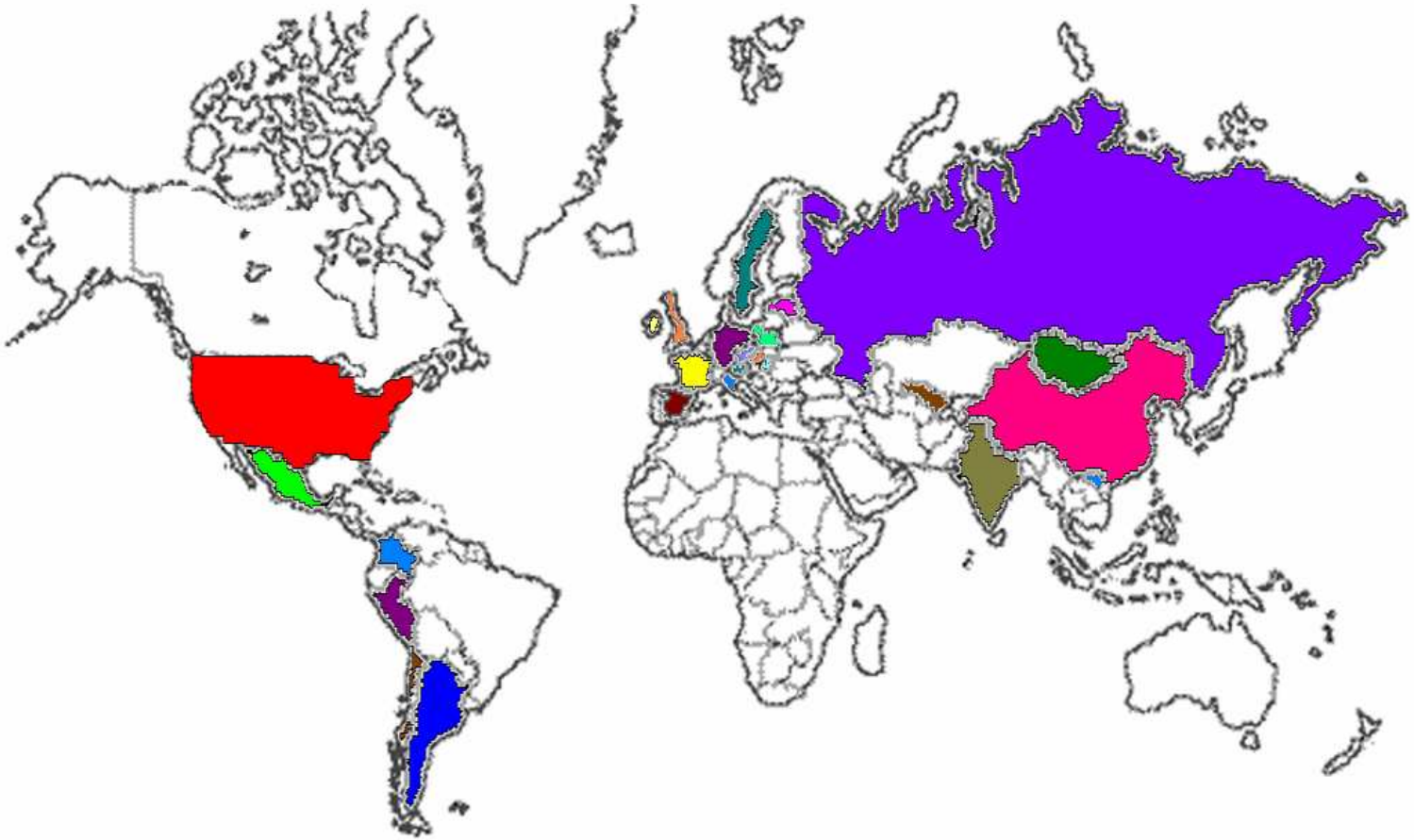
- Departamento de Tecnologías de la Información (BSC-CNS, **M. Valero**)
- Grupo Computación de Altas Prestaciones (U. Politècnica de Catalunya, **J. M. Llabería**)
- Parallel Processing and Distributed Systems group (U. Autónoma de Barcelona, **A. Ripoll**)

- Departamento de Tecnologías de la Información (BSC-CNS, **M. Valero**)
- Grupo Computación de Altas Prestaciones (U. Politècnica de Catalunya, **J. M. Llabería**)
- Grupo de Arquitectura de Computadores (U de Zaragoza, **V. Viñals**)
- Grupo de Arquitectura y Tecnología de Sistemas Informáticos (U. Complutense de Madrid, **F. Tirado**)
- Grupo de Arquitectura y Tecnología de Computadores (U. de Cantabria, J. R. **Beivide**)
- Grupo de Arquitectura de Computadores (U. de Malaga, **E. López Zapata**)
- Grupo de Arquitectura de Computadores (U. de Las Palmas de Gran Canaria, Instituto Universitario de Ciencias y Tecnologías Cibernéticas, **E. Fernández**)



BSC: Staff Evolution

BSC-CNS has 195 members from 21 different countries (Argentina, Belgium, Brazil, Bulgaria, Colombia, China, Cuba, France, Germany, India, Ireland, Italy, Lebanon, Mexico, Poland, Russia, Serbia, Turkey, the United Kingdom, the United States and Spain).



Comparing what we see and what we model about the Universe

Designing airplanes

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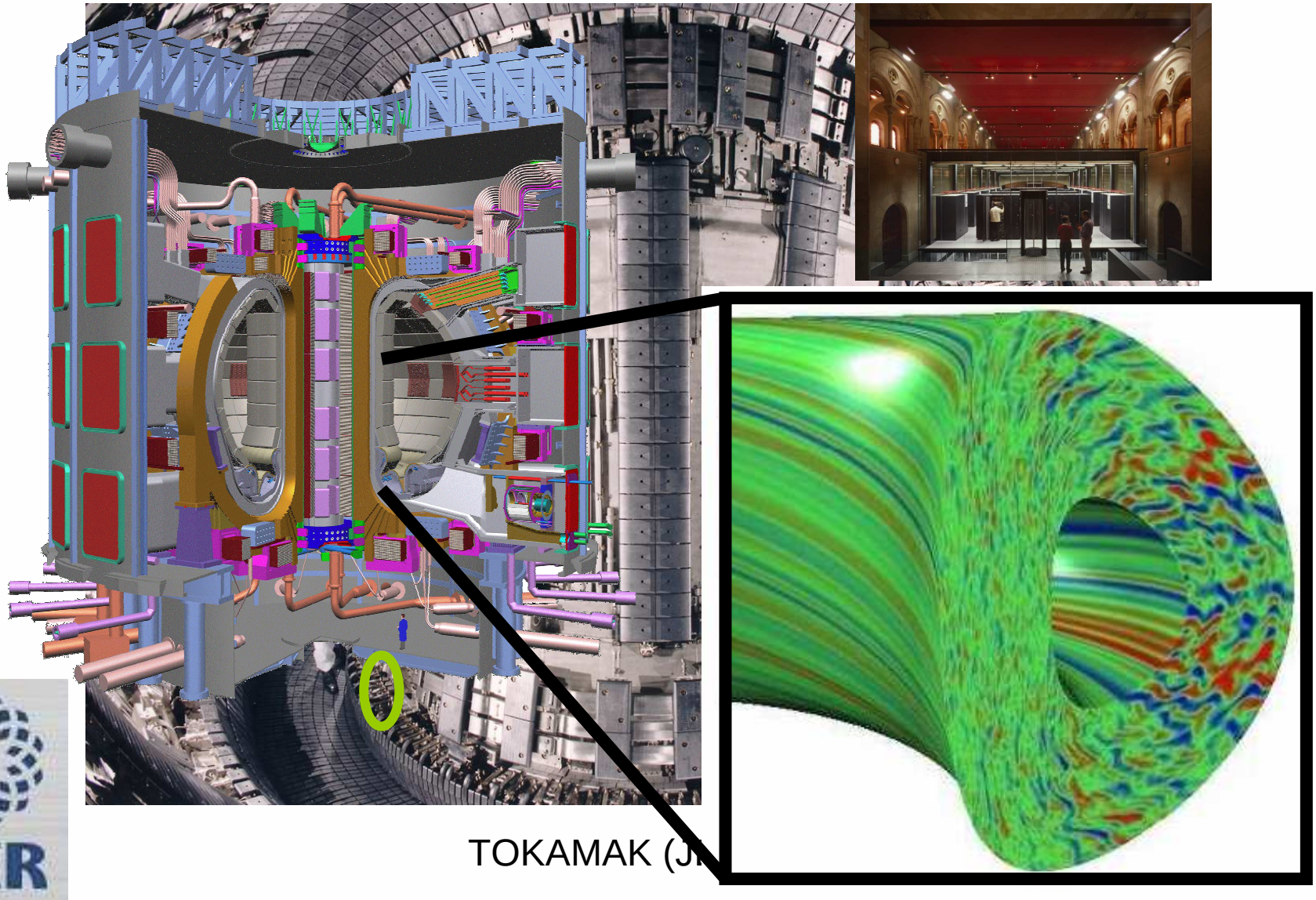
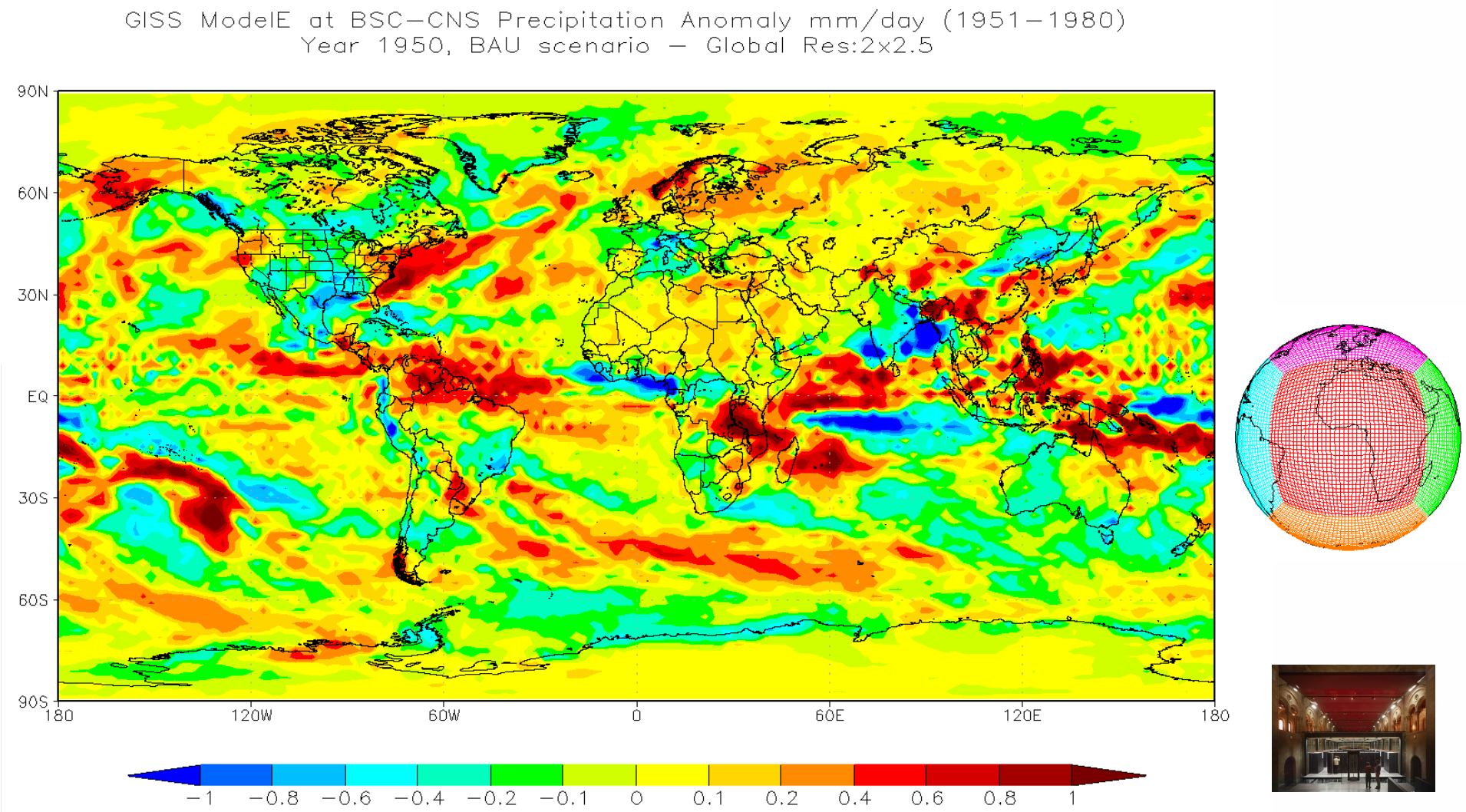
Designing Fusion Reactors

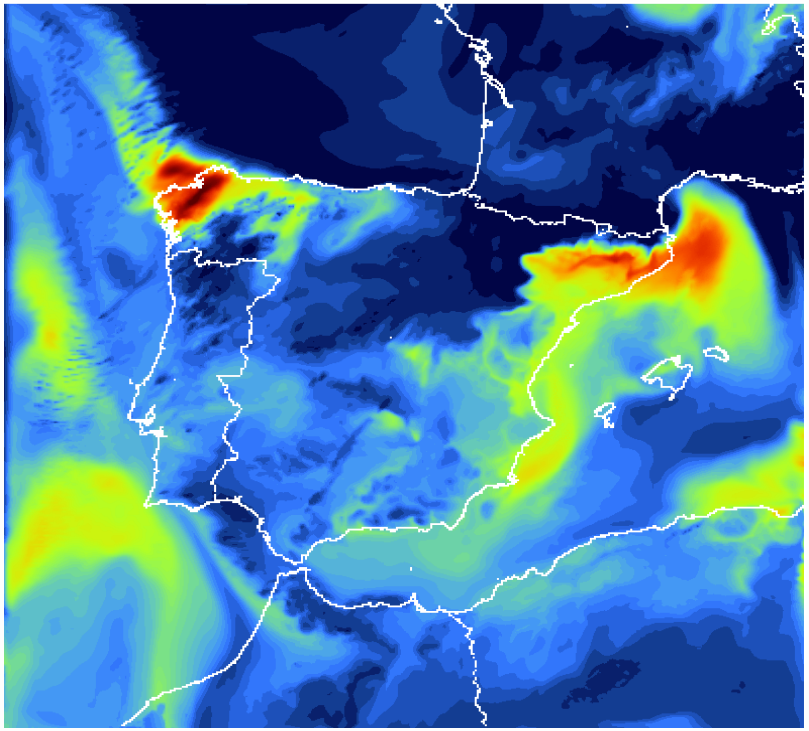


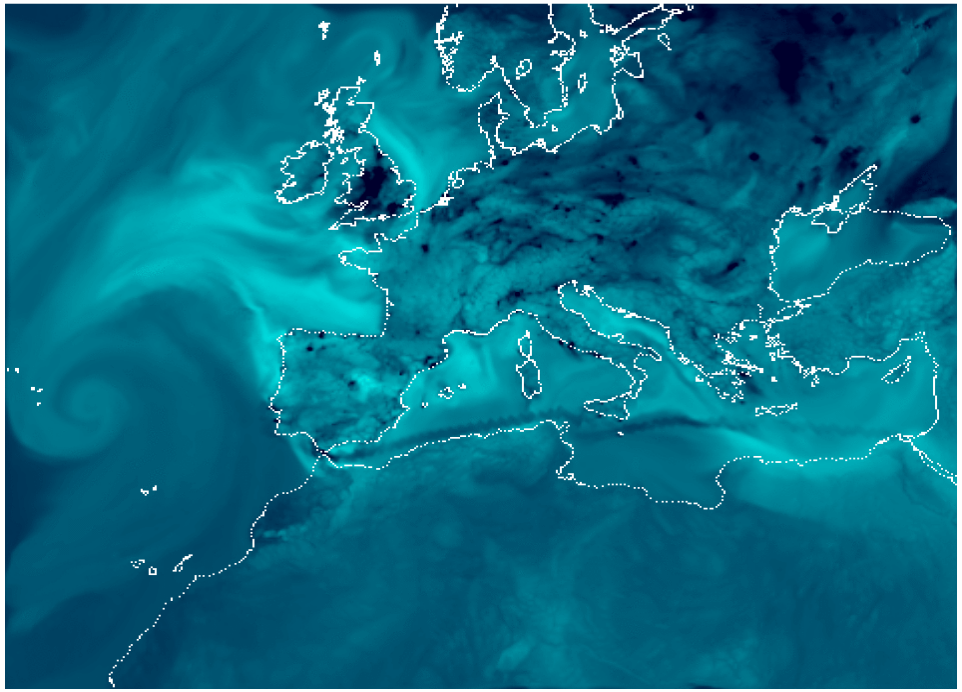
TOKAMAK (JI

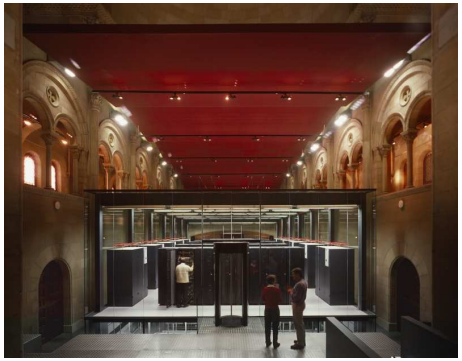
Understanding Climate change:



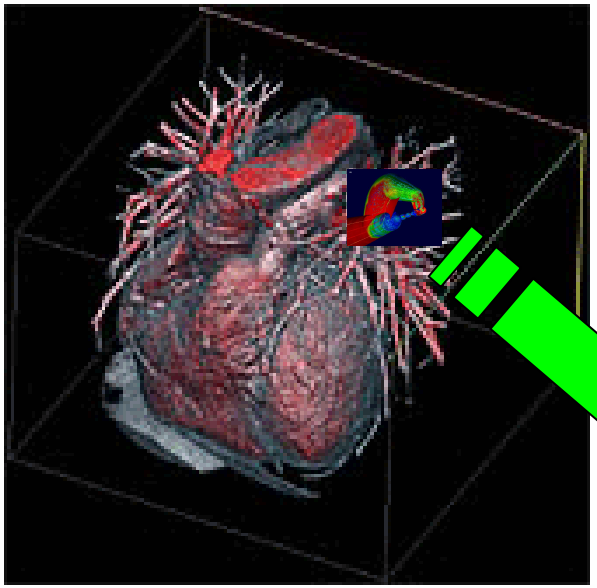
Forecasting air quality

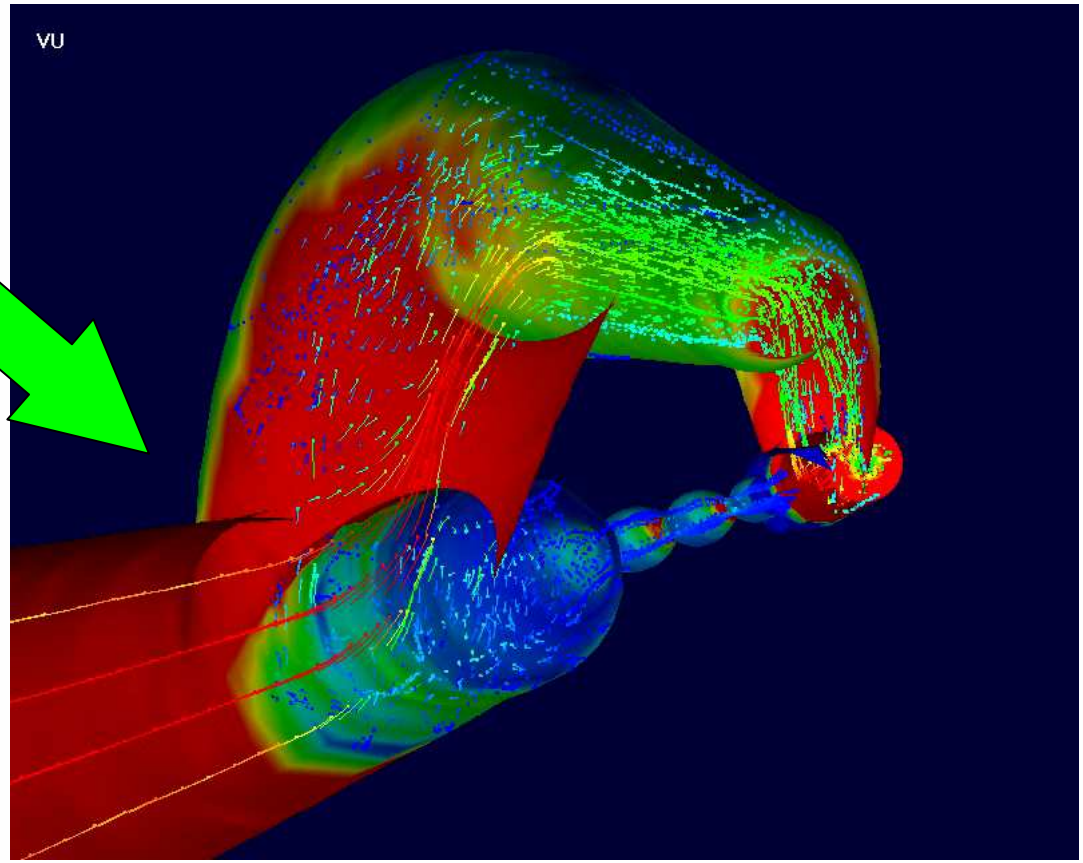


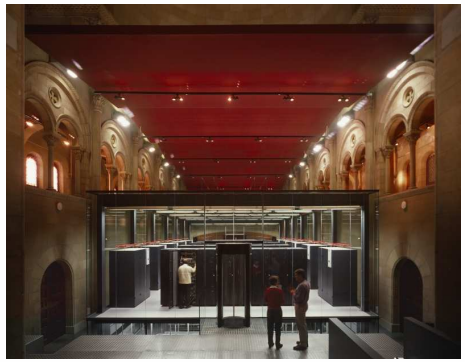




Simulating medical procedures

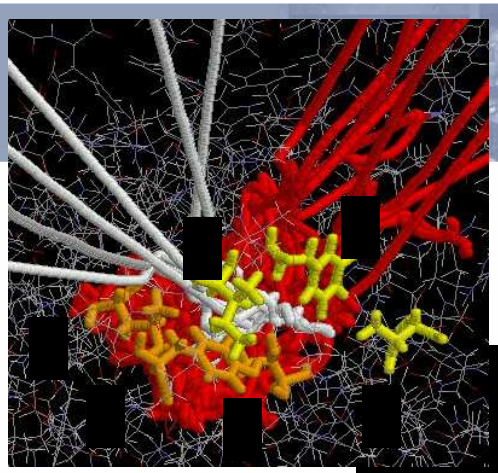


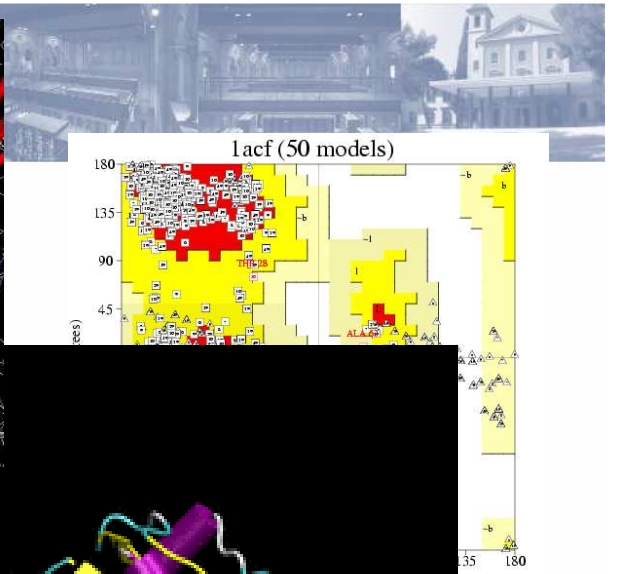


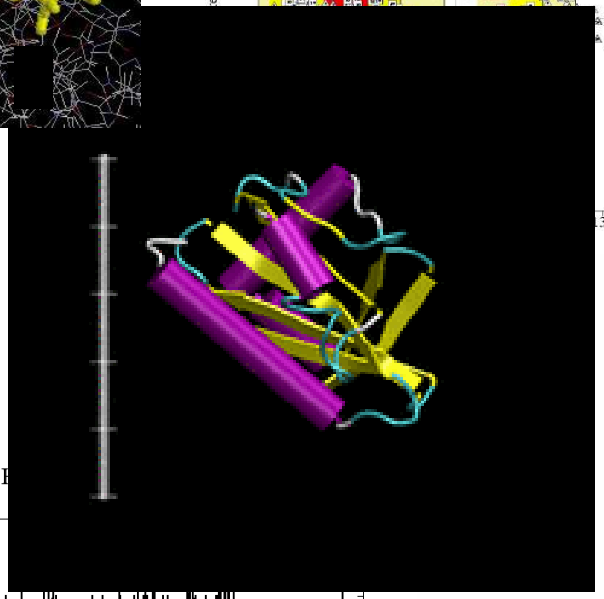


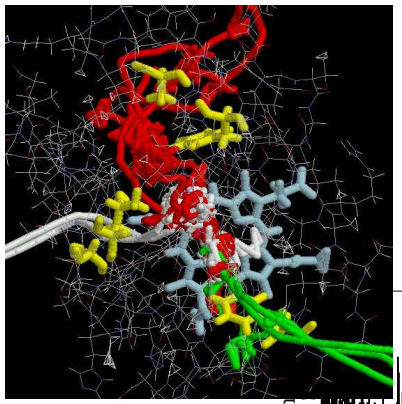
Modeling the proteins

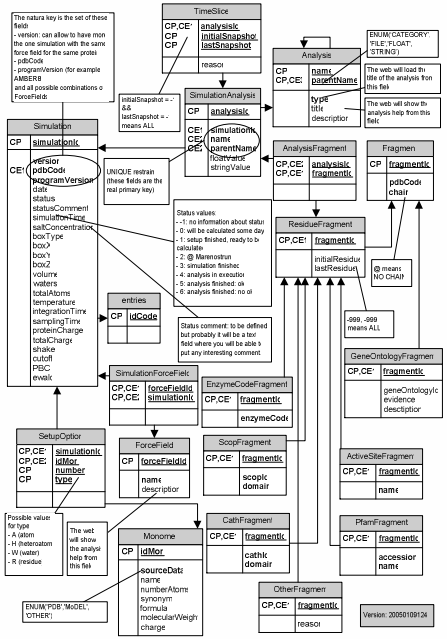
- Library of protein MD simulations
- 1400 at the moment
- >900 CPU years.
- 10 Tb of data

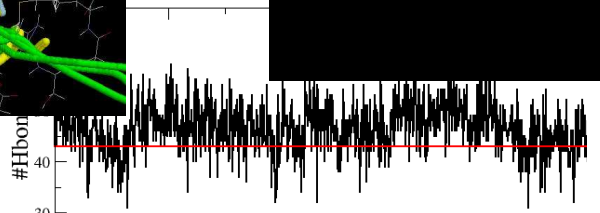


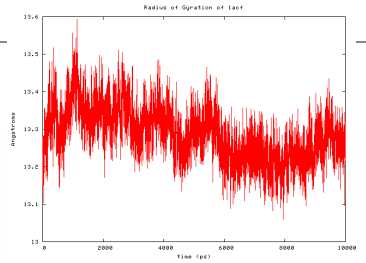


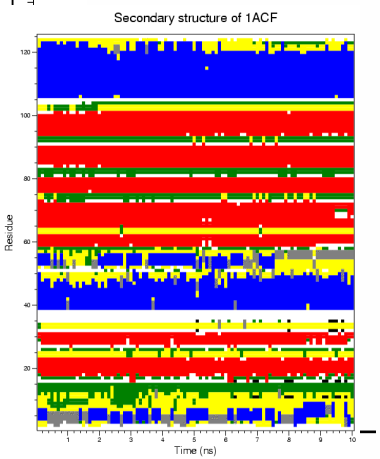












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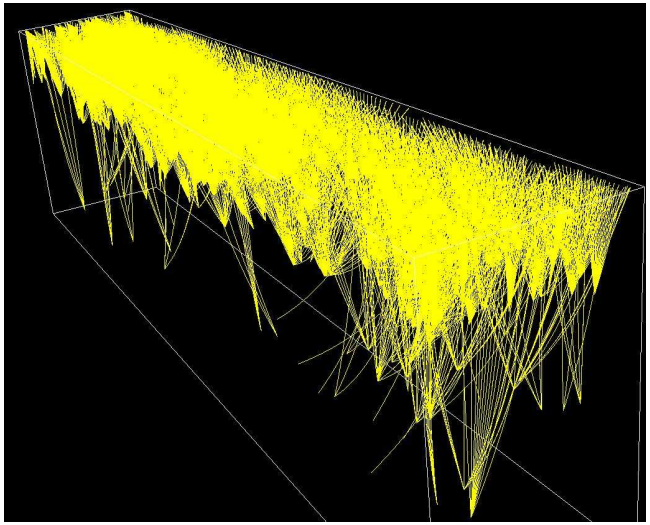
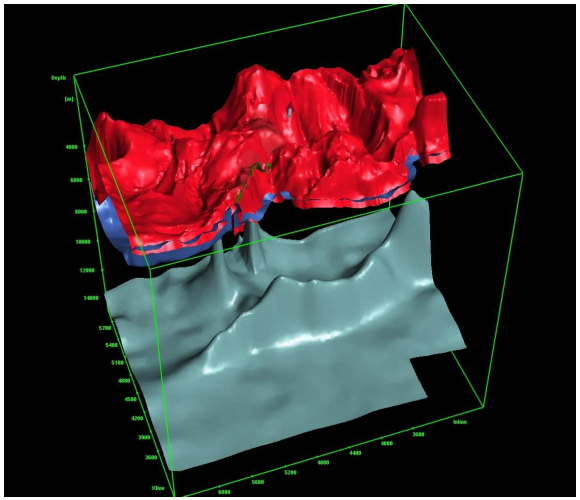
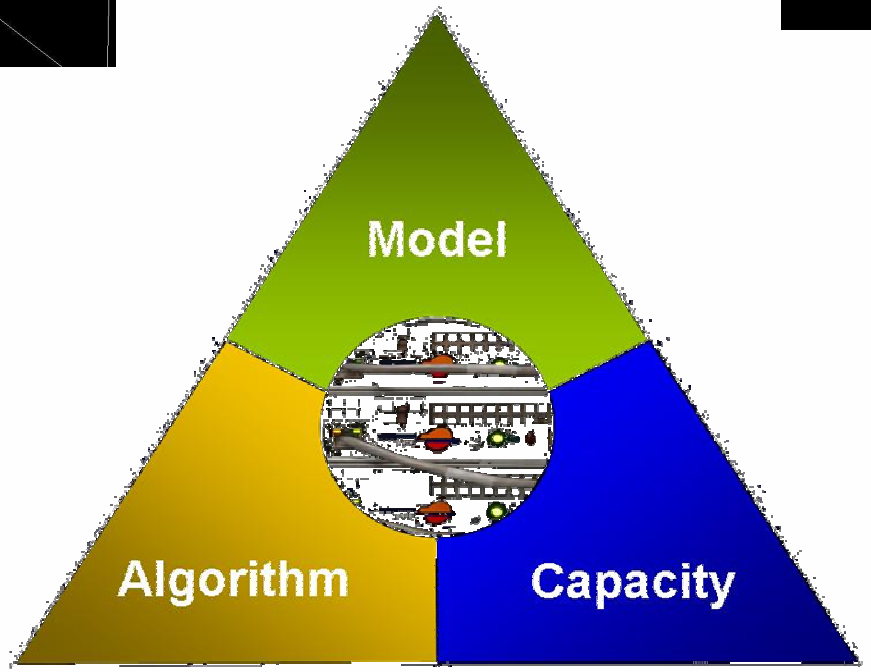
Searching for Oil and Gas

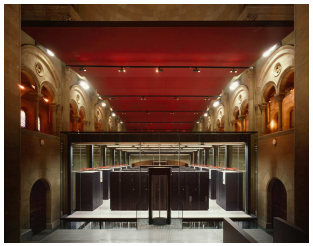




REPSOL YPF

Selected by "IEEE Spectrum" as one of the five most innovative technology initiatives in the year 2007





3DGEO DEVELOPMENT INC.

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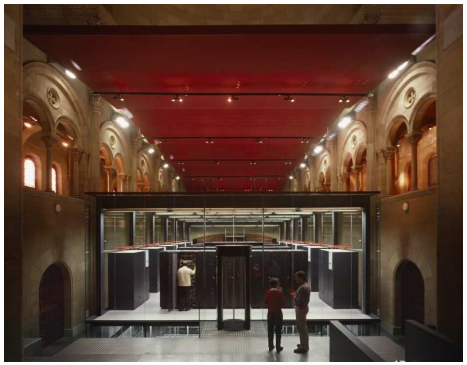
Developing the new supercomputers

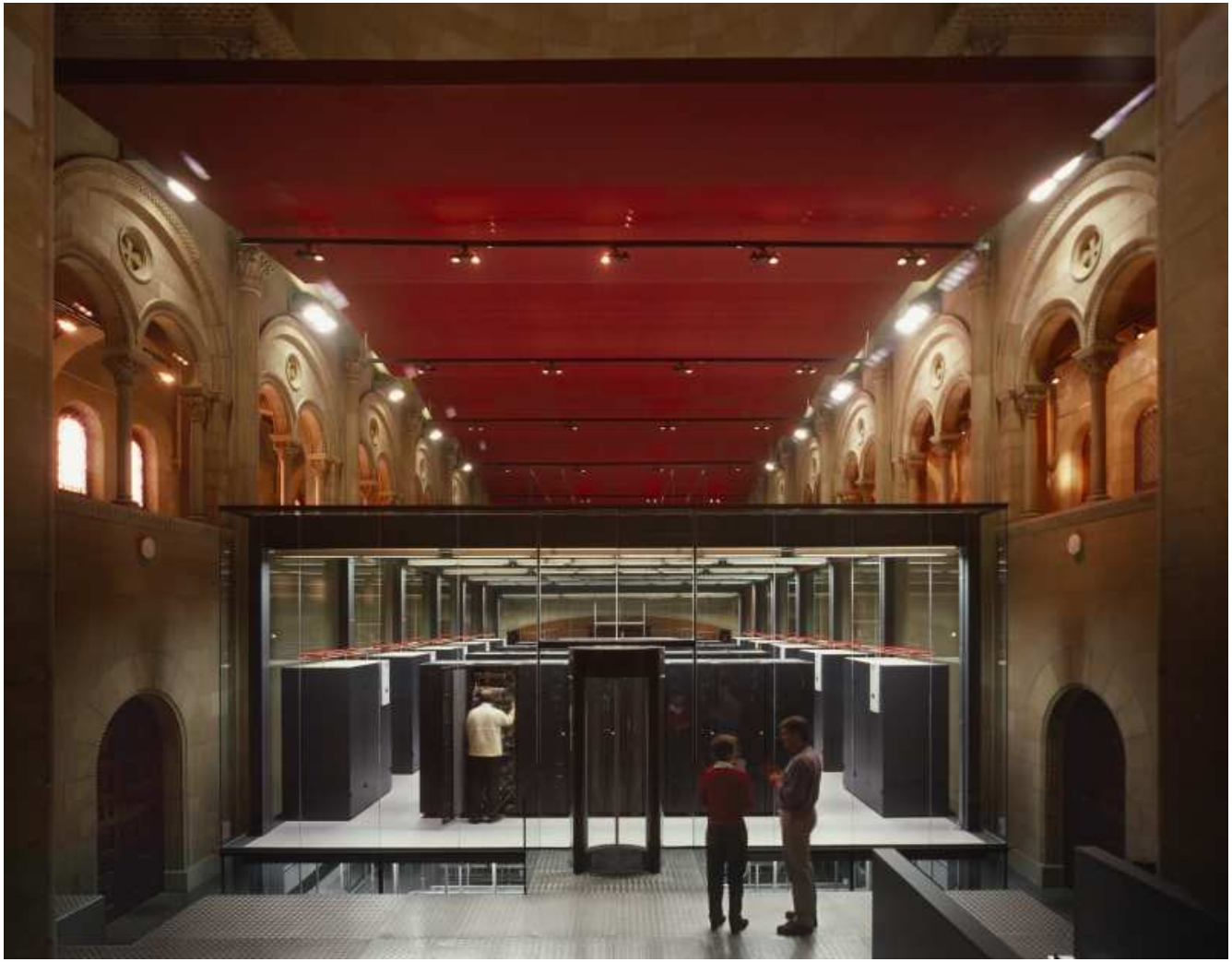
Convex C3480 (1991, 0.4 GF)

250x in 16 years

Procesador Cell (2007, 100 GF)



IBM

100x in 3 years ?

Thank you !